McCormick

Northwestern Engineering

Eugene W. Skinner and Eugene P. Lautenschlager Memorial Lecture

Designing Materials that Influence Stem Cell Biology

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This presentation will highlight the use of tunable engineered materials, exploiting both biochemical and mechanical inputs, to control stem cell function.

Biomimetic materials have been designed to emulate the regulatory processes involved in cell fate determination by employing ligands inspired by the natural extracellular matrix, cell–cell contacts, proteolytic remodeling, and growth factors with precisely engineered density, nanoscale arrangement, and presentation. With the discovery of human embryonic stem (hES) cells, which are distinguished by their capacity for self-renewal and pluripotent differentiation into any cell type in the adult body, biomimetic materials have accordingly generated a great deal of excitement as systems to control the stem cell microenvironment or niche. The combination of biomimetic materials and hES cells offers the potential of a universal source for cell-based therapeutics and tissue-based diagnostics. However, currently it is difficult to precisely control the behavior of hES cells, since microenvironmental conditions that regulate self-renewal and differentiation are incompletely understood. As a critical first step in controlling hES cell behavior in vitro, we assessed which adhesion receptors (i.e., integrins) hES cells employ to engage extracellular matrix (ECM) proteins. These data were critical in designing synthetic materials that recapitulate the integrin engagement repertoire found on Matrigel™, a broadly used hES cell adhesive matrix. While such biochemical signals that modulate stem cell function have been extensively studied, only recently have the mechanical properties of a stem cell's microenvironment also been shown to regulate its behavior. Thus, in addition to presenting ligands that engage with cell surface receptors, biomimetic materials offer another less appreciated, but extremely important property to modulate cell function: mechanical stiffness.

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February 11th, 4:00 p.m.
Technological Institute Room L211
2145 Sheridan Rd.
Reception to Follow, Room E311